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MATLAB Applications for Mathematics Students

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ABSTRACT

One of the oldest professions in human society is mathematics. It is closely tied to all stages of the development of human society's cognitive system. An essential tool for researching and resolving these real-world issues is mathematical modeling. A mathematical model is a structure that can be created mathematically by using the right tools and making the necessary, simplified assumptions about the underlying laws of a specific object and purpose in the real world. A mathematical model is an abstraction of real-world issues, to put it simply. Computer application technology has greatly influenced many different businesses as a result of computer progress. Among these, MATLAB is a piece of commercial math software that excels in applications for math in science and technology. One of the most widely used fourth-generation programming languages worldwide is MATLAB. It is one of the greatest environments for numerical analysis. Additionally, the most potent and effective language utilized in technical computing is MATLAB. It is designed to address mathematically notated challenges. It is employed in algorithm development and matrix calculations. Additionally, it enables us to run programmers written in any other programming language. It implies that MATLAB can make use of the advantages of other programming languages. It is extensively utilized in robotics, communications, control systems, signal processing, and image processing. This paper first examines MATLAB's benefits and discusses how to utilize it for mathematical operations and modeling.

1.1 Advantages of MATLAB

MATLAB is a multipurpose piece of software with its own unique programming language. It offers the following benefits:

(i) Since MATLAB is designed to readily handle mathematical operations like matrix multiplication and addition, we can complete the task by writing just one piece of code.

(ii) It is practical to create shorter standard loops in MATLAB that are equivalent to those that can be created in C or C++.

(iii) It is quite simple to create user-defined functions in MATLAB, and they can be saved in different files. This is helpful if we frequently employ a lot of operations or functions and don't want to write them out every time.

(iv) With just one command, we can import data from an excel or text file. If we wish to analyse previously recorded data, this is useful.

(v) We can store data into an excel file or a.mat file using MATLAB. Since there are ready-to-use instructions that can store integers in a vector or matrix without the need to build a loop, saving data in variables is incredibly easy.

(vi) Using add and drop boxes, MATLAB aids in the creation of a GUI (graphical user interface). It is convenient to build the GUI software in MATLAB into a standalone application that can run on any machine.

(vii) MATLAB is designed for a variety of applications in engineering, business, and economics, including curve fitting, dynamic system modeling and simulation, digital processing, and many others.

1.2 Positives

- MATLAB may function as a calculator or a programming language, and it combines computation and graphic plotting well.
- Learning MATLAB is really simple 62
- Because MATLAB is interpreted rather than compiled, faults are simple to correct. • MATLAB is designed to be rather quick when doing matrix operations.

- MATLAB does contain a few object-oriented components.

1.3 Weaknesses

- MATLAB is not a general-purpose programming language like C, C++, or FORTRAN.
- It is designed for scientific computing and is not well suited for other applications.
- It is an interpreted language, which makes it slower than a compiled language like C++.
- Its commands are only applicable to MATLAB usage.
- The majority of them don't directly correspond to commands in other programming languages.
- MATLAB instructions are only to be used with MATLAB. The majority of them lack direct equivalents in other programming languages.

1.4 Making a calculator out of MATLAB

Simply type the expression you want to evaluate to do a basic interactive calculation. Let's begin at the beginning. Consider the situation when you need to calculate the formula 1 + 2 x 3. You enter it as follows at the command prompt (>>)

```
>> 1+2*3
 ans = 7
```

The response variable, abbreviated as ans in MATLAB, is used by default to hold the outcomes of the current calculation if you do not provide an output variable. Observe that the variable ans is established (or overwritten, if it is already existed). You can give a value to a variable or output argument name to prevent this. For illustration

>> x = 1+2*3 x = 7

will result in x being given the value 1 + 2 × 3 = 7. This variable name can always be used to refer to the results of the previous computations. Therefore, computing 4x will result in

```
>> 4*x
ans = 28.0000
```

Symbol	Operation	Example
+	Addition	2 + 3
−	Subtraction	2 − 3
*	Multiplication	2 * 3
/	Division	2 / 3

1.5 Creating MATLAB variables

A statement of assignment is used to generate MATLAB variables. Variable name = a value is the syntax for assigning variables (or an expression)

For instance,

>> x = expression, where expression consists of a number of variables, function calls, mathematical operators, and numerical values. In other words, expression may involve manual entry, built-in features, and user-defined features.

1.6 Controlling the hierarchy of operations or precedence

Managing the order or hierarchy of operations Take into account the last arithmetic operation, but this time add parentheses. As an illustration, 1 + 2 3 will become (1 + 2) 3

>> (1+2)*3 ans = 9 and, from the previous example

>> 1+2*3 ans = 7.

These two expressions produce various outcomes by adding parentheses: most software for computers, 9 and 7. Evaluation is carried out from left to right for operators with equal precedence. Consider this second illustration: 1 2 + 32 + 4 5 × 6 7 MATLAB changes it to

>> 1/(2+32)+4/5*6/7 ans = 0.7766

If parenthesis are absent, the formula is:

>> 1/2+32+4/5*6/7 ans = 10.1857

2.0 Algebraic operations For technical computing:

MATLAB, which has a sizable collection of mathematical functions, offers several predefined mathematical functions. You can access complete listings of elementary and special functions by typing help el fun and help spec fun, respectively. Some frequently used functions are listed in Table 2.1, where x and y are either numbers, vectors, or matrices.

Table 2.1: Foundational operations

cos(x)	Cosine	abs(x)	Absolute value
sin(x)	Sine	sign(x)	Signum function
tan(x)	Tangent	max(x)	Maximum value
acos(x)	Arc cosine	min(x)	Minimum value
asin(x)	Arc sine	ceil(x)	Round towards +∞
atan(x)	Arc tangent	floor(x)	Round towards −∞
exp(x)	Exponential	round(x)	Round to nearest integer
sqrt(x)	Square root	rem(x)	Remainder after division
log(x)	Natural logarithm	angle(x)	Phase angle
log10(x)	Common logarithm	conj(x)	Complex conjugate

In addition to the elementary functions, MATLAB includes a number of predefined

Examples- We illustrate here some typical examples which related to the elementary functions previously defined. As a first example, the value of the expression
$y = e^{-a}\sin(x) + 10\sqrt{y}$, for a = 5, x = 2, and y = 8 is computed by

```
>> a = 5; x = 2; y = 8;
>> y = exp(-a)*sin(x)+10*sqrt(y)  y = 28.2904
```

The subsequent examples are `>> log(142)` ans = 4.9558
`>> log10(142)` ans = 2.1523

2.2 Creating simple plots

The basic MATLAB graphing procedure, for example in 2D, is to take a vector of xcoordinates, x = (x1, . . . , xN), and a vector of y-coordinates, y = (y1, . . . , yN), locate the points (xi , yi), with i = 1, 2, . . . , n and then join them by straight lines. You need to prepare x and y in an identical array form; namely, x and y are both row arrays or column arrays of the same length.

The MATLAB command to plot a graph is plot(x,y). The vectors x = (1, 2, 3, 4, 5, 6) and y = (3, −1, 2, 4, 5, 1) produce the picture shown in Figure 2.1.

```
>> x = [1 2 3 4 5 6];

>> y = [3 -1 2 4 5 1];

>> plot(x,y)
```

For example, to plot the function sin (x) on the interval [0, 2π], we first create a vector of x values
ranging from 0 to 2π, then compute the sine of these values, and finally plot the result:

```
>> x = 0:pi/100:2*pi;

>> y = sin(x);

>> plot(x,y)
```

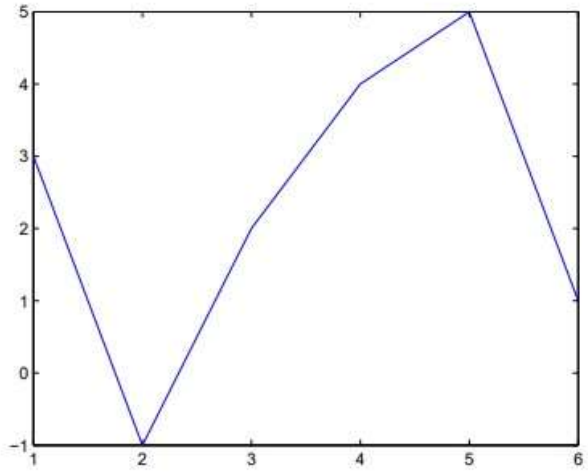

Figure 2.1: Plot for the vectors x and y

Note: It should be noted that the plot functions have several forms based on the input inputs. If y is a vector, plot(y) creates a piecewise linear graph plotting the elements of y against their index. Plot(x,y) creates a graph of y versus x when two vectors are specified, as was previously explained.

3.0. Conclusion

Finality Mathematical fundamentals should be taught to students, but they should also learn how to apply those fundamentals creatively. One of the fundamental characteristics that college students should have is mathematical application consciousness and practical skill. The use of MATLAB mathematical computer software and mathematical modeling training is a key strategy for achieving this goal. Therefore, we should actively research effective teaching strategies that use MATLAB, assimilate new teaching materials, and concepts throughout time, which is more beneficial to the growth of mathematical modeling. Because knowledge is replaced more quickly as a result of the computer era and the emergence of numerous new techniques and technologies, the mathematical modeling course will also change. As a result, there is still a long way to go in the reform of the mathematical modeling course, and we must keep cooperating.

References

1. Patricia Cretchley, Chris Harman, Nerida Ellerton, and GerardFogarty (2000), MATLAB in Early UndergraduateMathematics: An Investigation into the Effects of ScientificSoftware on Learning. Mathematics Education ResearchJournal, Vol. 12, No.3, 219-233
2. M. Abdul Majid, Z. A. Huneiti, M. A. Al-Naafa1, W.Balachandran (2013). A Study of the Effects of Using Matlab asa Pedagogical Tool for Engineering Mathematics Students.International Journal of Online and Biomedical Engineering Vol9, No 2 (iJOE) – eISSN: 2626-8493

3. M. Abdul Majid, Z. A. Huneiti, W. Balachandran, Y. Balarabe(2013), MATLAB AS A TEACHING AND LEARNINGTOOL FOR MATHEMATICS: A LITERATURE REVIEW.International Journal of Arts & Sciences, CD-ROM. ISSN:1944-6934 :: 6(3):pp.23–44
4. David Houcque, (2005), INTRODUCTION TO MATLAB FORENGINEERING STUDENTS, Northwestern University.
5. Seifedine Kadry, (2014) Learning Basic Mathematics UsingMATLAB, International Journal of Information Technology &Computer Science (www.ijitcs.com) Volume 14 Issue No 2,May 2014 ISSN (online) : pp. 2091-1610
6. Ian Allan Thomson (2015), USING MATLAB INSECONDARY SCHOOL MATHEMATICSINVESTIGATIONS. MATHEMATICS: LEARN LEAD LINK• © AAMT.
7. Charles-Ogan, Gladys Ibibo, (2015) Utilization of Matlab as aTechnological Tool for Teaching and Learning of Mathematicsin Schools. International Journal of Mathematics and StatisticsStudies Vol.3, No.5, pp.10-24.
8. Stormy Attaway (2009), Matlab: A Practical Introduction toProgramming and Problem Solving, ISBN: 978-0-75-068762-1Elsevier
9. M. Abramowitz and I.A. Stegun. Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables. National Bureau of Standards, Applied Math. Series #55. Dover Publications, 1965.
10. J. H. Ahlberg, E. N. Nilson, and J. L. Walsh. The Theory of Splines and Their Applications. Mathematics in Science and Engineering, Volume 38. Academic Press, 1967.
11. J. Albrecht, L. Collatz, W. Velte, and W. Wunderlich, editors. Numerical Treatment of Eigenvalue Problems, volume 4. Birkhauser Verlag, 1987.